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UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/517,314 03/02/00 CHO

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Washington DC 20037-1526

EXAMINER

KANG, D

ART UNIT

PAPER NUMBER

2811

DATE MAILED:

07/24/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

09/517,314

Applicant(s)

CHO, CHIH-CHEN

Examiner

Donghee Kang

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 May 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-18,20-32 and 39 is/are pending in the application.
- 4a) Of the above claim(s) 2 and 19 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3-18,20-32 and 39 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on 14 May 2001 is: a) ☒ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Acknowledgement

1. Applicant's Amendment and Response to Paper No.7 has been entered and made of record (Paper No.10). Claims 2 and 19 have been cancelled and Claim 39 has been added. Therefore, Claims 1, 3-18, 20-32, and 39 are pending.

Response to Amendment

2. In view of applicant's amendment to the claim, the rejection of claims 17 and 26 under 35 U.S.C. 112 first paragraph has been withdrawn.

3. In view of applicant's amendment to the claim, the rejection of claims 11 and 25 under 35 U.S.C. 112 second paragraph, as being indefinite, has been withdrawn.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims **1, 3-4, 9-12, 15-16, 18-19, & 22-24** are rejected under 35 U.S.C. 102(b) as being anticipated by Chiang et al. (US 5,739,579).

Regarding claims **1, 3-4, 9-10, 18-19, & 22-24**, Chiang et al discloses a semiconductor structure comprising (Fig.9):

an insulating layer (22); a conductive plug (41) positioned within said insulator layer (22); an etch-stop layer (23) located on said insulator layer (22) and surrounding said plug (41), wherein said etch-stop layer comprises silicon nitride or silicon carbide; a

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non-conductive layer (50) having an etched via at least partially over said conductive plug (41); a conductive connector (60 & 61) formed in said via in electrical contact with said plug (41) and including a first conductive layer (60) deposited in and in contact with said etched via and a second conductive layer (61) deposited over said first conductive layer (60), said first conductive layer including a portion in contact with said conductive plug (41), wherein said first conductive layer comprises titanium nitride (Col.8, line 60) and said second conductive layer comprises copper (Col.8, line 66); a connection region (21) in a substrate, wherein said conductive plug (41) is provided over said connection region (21).

Regarding claims **11-12 & 15-16**, Chiang et al discloses a semiconductor device comprising (Fig.9):

at least one memory cell comprising:

an active region (21) in a substrate; a conductive plug (41) positioned within an insulator (22) and provided on said active region (21), said conductive plug being in contact with said active region; an etch-stop layer (23) deposited on said insulator (22) and around said conductive plug (41); an intermediate non-conductive layer (50) provided over said etch stop layer and having an etched via over said plug (41); and at least one conductive layer (60 & 61) formed in said via and in electrical contact with said plug (41) and including a first conductive layer (60) deposited in and in contact with said etched via and a second conductive layer (61) deposited over said first conductive layer (60), said first conductive layer including a portion in contact with said conductive plug

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(41), wherein said first conductive layer comprises titanium nitride (Col.8, line 60) and said second conductive layer comprises copper (Col.8, line 66); a connection region (21) in a substrate, wherein said conductive plug (41) is provided over said connection region (21).

Claim Rejections – 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 5-6, 17, 25-27, 30-32, & 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al (US 5,739,579) in view of Wang et al (US 6,184,128).

Regarding claim 5, Chiang et al discloses the entire claimed invention, as applied to claim 1 above, except for non-conductive layer (etch-stop layer) comprising a silicon dioxide. Wang et al teach in Fig.7 the silicon dioxide layer acts as an etch-stop layer (Col.5, lines 49-64).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the silicon nitride of Chiang's device with a well known silicon dioxide as taught by Wang et al in order to provide the etch stop layer in the device. Furthermore, one of ordinary skill in the art would have recognized that the silicon nitride and silicon dioxide are both considered to be an art recognized functional equivalent for serving as an etch-stop layer for BPSG dielectric layer.

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Regarding claim 6, Chiang et al discloses the entire claimed invention, as applied to claim 1 above, except for non-conductive layer (etch-stop layer) comprising silicon nitride and silicon carbide. However, Wang et al teach in Fig.7 etch stop layer (13) includes the silicon nitride and silicon carbide layer (Col.5, lines 49-64).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the silicon nitride of Chiang's device with silicon nitride and silicon carbide layers as taught by Wang et al in order to provide the etch stop layer in the device. Furthermore, one of ordinary skill in the art would have recognized that the silicon nitride and silicon dioxide are both considered to be an art recognized functional equivalent for serving as an etch-stop layer for BPSG dielectric layer.

Moreover, it would have been obvious to one having ordinary skill in the art at the time the invention was made to form the etch-stop layer, *having the materials as claimed*, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Regarding claims 17 & 39, Chiang et al disclose the claimed invention except for a plurality of memory cells. It would have been obvious to one having ordinary skill in the art at the time the invention was made to form a plurality of memory cells, since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art. *St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8.

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Regarding claims **25-27 & 30-32**, Chiang et al discloses a semiconductor device comprising (Fig.9):

a substrate (20) supporting a connection region (21); an insulating layer (22); a conductive plug (41) positioned within said insulator layer (22); an etch-stop layer (23) located on said insulator layer (22) and surrounding said plug (41), wherein said etch-stop layer comprises silicon nitride or silicon carbide; a non-conductive layer (50) having an etched via at least partially over said conductive plug (41); a conductive connector (60 & 61) formed in said via in electrical contact with said plug (41) and including a first conductive layer (60) deposited in and in contact with said etched via and a second conductive layer (61) deposited over said first conductive layer (60), said first conductive layer including a portion in contact with said conductive plug (41), wherein said first conductive layer comprises titanium nitride (Col.8, line 60) and said second conductive layer comprises copper (Col.8, line 66); a connection region (21) in a substrate, wherein said conductive plug (41) is provided over said connection region (21).

Chiang et al does not explicitly teach a processing unit which is coupled to a semiconductor device. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have a processor unit in processor-based device, since the processor is required in the processor-based device to operate a device.

8. Claims **7-8, 13-14, 20-21, & 2^o-29** are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al (US 5,739,579) in view of Hong et al (US 6,008,117).

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Chiang et al disclose substantially the entire claimed structure, as applied to claims 1, 11, 18 & 25 above, except for non-conductive layer comprises borophosphosilicate glass (BPSG). However, Hong et al teaches in Fig.1H the non-conductive layer disposed on the etch-stop layer comprises BPSG. *See also Col.3, lines 16-19.*

It is well known and conventional to form dielectric layer using BPSG in the art. It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the SiO₂ of Chiang's device with a conventional BPSG material as taught by Hong in order to provide a dielectric layer which has a less etch rate than etch-stop layer. Furthermore, one of ordinary skill in the art would have recognized that the SiO₂ and BPSG are both considered to be art recognized functional equivalent for providing a dielectric layer and therefore an obvious expedient. Moreover, it would have been obvious to one having ordinary skill in the art the invention was made to form the dielectric layer, *having the materials as claimed*, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Donghee Kang whose telephone number is 703-305-9147. The examiner can normally be reached on Monday through Friday.

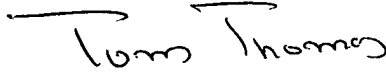
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers

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for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Donghee Kang, Ph.D.
July 23, 2001


TOM THOMAS
SUPERVISORY PATENT EXAMINER